

Patterns of heroin, cocaine, and alcohol abuse during long-term methadone maintenance treatment

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Abstract

Individuals' use of heroin, cocaine, and alcohol during long-term methadone maintenance treatment (MMT) was studied. Prospectively collected data from 103 heroin-addicted individuals who were consecutively admitted for MMT and remained 2 years in treatment were evaluated. The patients were assessed every 6 months with a standardized interview. Three longitudinal patterns of drug abuse were identified. A proportion of patients abstained fully from their particular drug use (26% from heroin, 39% from cocaine, and 19% from alcohol); a proportion (39%, 32%, and 47%, respectively) switched between periods of abuse and nonuse of these drugs; and chronic drug users (34%, 28%, and 33%, respectively) continued use, including periods of daily abuse throughout MMT. Different therapeutic interventions may be needed in patients with different longitudinal patterns of additional substance use during MMT. © 2005 Elsevier Inc. All rights reserved.

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1. Introduction

Methadone maintenance treatment (MMT), a widely used form of opioid replacement therapy, is an effective intervention for the treatment of heroin dependence: It retains patients in treatment, decreases heroin use and related crime and health problems (Bertschy, 1995; Mattick, Breen, Kimber, & Davoli, 2003), and improves survival (Esteban et al., 2003). Nevertheless, many patients continue to consume illicit substances and/or alcohol despite their daily dose of methadone (Gollnisch, 1997; Ward, Mattick, & Hall, 1998; Wasserman, Weinstein, Havassy, & Hall, 1998). Additional heroin and alcohol use can be reduced by higher methadone doses (Hartel et al., 1995; Maxwell & Shinderman, 1999), and patients undergoing MMT were claimed to be better able to control their heroin intake

(Bianchi, Maremmanni, Meloni, & Tagliamonte, 1992). Chronic or intermittent additional cocaine use occurs in some 70% of patients undergoing MMT. It seems to be independent of the methadone dose; its frequency does not decrease with the length of treatment (Grella, Anglin, & Wugalter, 1997; Schottenfeld, Pakes, Oliveto, Ziedonis, & Kosten, 1997) and it increases the rate of antisocial and health risk behavior (Camacho, Bartholomew, Joe, Cloud, & Simpson, 1996; Grella et al., 1997; Grella, Anglin, & Wugalter, 1995). Additional alcohol dependence occurs in some 20–40% of patients undergoing MMT (el-Bassel, Schilling, Turnbull, & Su, 1993; Hillebrand, Marsden, Finch, & Strang, 2001). Alcohol consumption increases whenever a decrease occurs in narcotic use (Hser, Anglin, & Powers, 1990), alcohol and heroin consumption being inversely related (Anglin, Almog, Fisher, & Peters, 1989). Short-term MMT may decrease whereas longer-term MMT may increase alcohol consumption (Caputo et al., 2002).

Unfortunately, most studies dealing with concurrent drug use in MMT were based on only one follow-up assessment,

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studied only one additional substance of abuse, and included a short observation period of up to 1 year. They did not consider different course profiles during the treatment (Morral, Iguchi, Belding, & Lamb, 1997). Thus, our knowledge about the effectiveness of methadone treatment remains limited and questions about duration, intensity, and constancy of additional drug use are yet to be answered.

We studied the longitudinal course of additional substance abuse during uninterrupted MMT. The salient features of our study are as follows: (1) repeated assessments were carried out; (2) abuse of three substances (heroin, cocaine, and alcohol) was considered; (3) study duration extended over 2 years; and (4) data were prospectively collected.

2. Materials and methods

2.1. Study sample

Between 1996 and 1998, a total of 382 patients started MMT while being active heroin users at an outpatient treatment facility for patients with substance use disorders (ZOKL 1) in Zurich. Of these 382 consecutive patients, 103 qualified for the present study, all of them having fulfilled the following criteria: (1) they were all diagnosed with heroin dependence according to ICD-10 (World Health Organization, 1991) and *DSM-IV* (American Psychiatric Association, 1994); (2) they were all active heroin users at the time of their entry for treatment; (3) they stayed for 2 years or longer in the methadone program; (4) they gave their informed consent for study participation; and (5) they adhered sufficiently to the study protocol (i.e., they completed all interviews, although they did not always deliver the complete data sets).

Table 1 shows some basic sociodemographic and substance abuse-related data on the study participants and a comparison of those with the corresponding data on

nonparticipants. With the exception of “own accommodation,” no significant differences were found between the study group and the rest of the patients.

2.2. Treatment facility and program

ZOKL 1 is a medically directed private nonprofit institution devoted to treating patients with substance use disorders. The patients are quickly and nonbureaucratically admitted; thus, socially marginalized drug users can also be reached. The treatment program is individually planned for each patient. The basic goal is not abstinence, but harm reduction, including prevention of criminal behavior, prostitution, malnutrition, somatic problems, and demoralization. The patients obtain methadone substitution, social support, medical care, and, if desired, psychotherapy. Help for drug withdrawal and abstinence is offered, provided it is desired by a patient and both the patient and the therapist agree on abstinence to be a realistic goal when considering the whole patient’s situation. Additional drug use, including alcohol use, is regularly addressed and discussed in a factual, nonjudgmental way. Alternatives are explored without discouraging additional drug use explicitly, and additional drug use has no negative consequences, such as discharge, temporary exclusion from treatment, and even disapproval.

2.3. Data collection

Every 3 months, all program participants completed a questionnaire used in the frame of the Swiss National Cohort Study on the prescription of narcotics for heroin-addicted individuals (Uchtenhagen et al., 1999). The questionnaire was devised with reference to the Addiction Severity Index (ASI; McLellan, Luborsky, O’Brien, & Woody, 1980) and contains data on social situation, medical status, and additional drug use—measured during the prior 30 days. The completion of the questionnaire was controlled by the responsible therapist who himself or herself completed an additional questionnaire every 6 months.

In this study, the questionnaire data on the nonprescribed use of heroin, cocaine, and alcohol were evaluated. The data considered were obtained on admission and at 6, 12, 18, and 24 months of treatment. At each of these time points, substance abuse over the last 4 weeks preceding the evaluation interview was explored. This time format was chosen in correspondence with ASI instructions. Three categories of abuse were differentiated: no abuse, occasional abuse, and daily abuse, disregarding the amount of the ingested drug. In the case of alcohol, the daily intake of alcoholic beverages containing more than 60 g of alcohol was rated as daily abuse and the less-frequent intake of the same amount was rated as occasional abuse.

The methadone doses were automatically documented when patients came to get their dose. For the analysis, the average doses over the last 14 days before the interview were computed.

Table 1

Comparison of study participants and nonparticipants with regard to some sociodemographic and substance abuse-related variables

	Study patients (<i>n</i> = 103)	Other patients (<i>n</i> = 279)	Significance ^a	
			χ^2/F	<i>p</i>
Sex: men [<i>n</i> (%)]	68 (66)	199 (71)	<i>ns</i>	
Age, years (<i>M</i> ± <i>SD</i>)	30.1 ± 5.9	29.5 ± 6.2	<i>ns</i>	
Employed [<i>n</i> (%)]	43 (42)	117 (42)	<i>ns</i>	
Social welfare benefits [<i>n</i> (%)]	56 (54)	130 (47)	<i>ns</i>	
Own accommodation [<i>n</i> (%)]	60 (58)	105 (39)	11.15	.001
Duration of heroin use, years (<i>M</i> ± <i>SD</i>)	8.7 ± 5.1	9.0 ± 5.4	<i>ns</i>	
Daily heroin use [<i>n</i> (%)]	62 (60)	184 (66)	<i>ns</i>	
Duration of cocaine use, years (<i>M</i> ± <i>SD</i>)	8.9 ± 4.6	9.2 ± 5.5	<i>ns</i>	
Daily cocaine use [<i>n</i> (%)]	24 (23)	78 (28)	<i>ns</i>	

^a χ^2 Test was used for categorical variables; *F* test, for continuous variables.

As an inherent part of the MMT program, urine screens were taken every 3 months from all patients. Unfortunately, the results of these screens are not exactly comparable with the data of the questionnaires as the screens are not always taken at exactly the same time and obviously cover shorter periods than the 4-week period covered by the questionnaires. In 2001, in spite of these reservations, all results of the urine tests were checked against patients' self-reports. The results for all patients (including less-compliant patients) did not indicate a higher rate of underreporting than overreporting. Compared were 5,718 urine samples for heroin and 5,213 for cocaine. Based on the results of urine tests, there were 17.8% false-negative and 12.5% false-positive self-reports for heroin and 10.7% false-negative and 20.4% false-positive self-reports for cocaine.

2.4. Statistical evaluation

In the first step, cross-sectional trends were computed with the help of the nonparametric McNemar χ^2 test (continuity corrected) and binomial exact test (two tailed). In the second step, hierarchical cluster analyses (Norusis, 1994) were carried out to identify the typical longitudinal patterns of additional substance abuse. Hierarchical clustering is a descriptive statistical technique that serves to identify groups of cases having similar responses to a set of variables. The goal was to have large-enough groups with as high as possible intragroup homogeneity and intergroup heterogeneity. In the present study, the goodness of the solution was tested by discriminant analysis, the solution variable serving as the dependent variable and the grouping variables as independent variables. The higher the percentage of correctly classified cases, the better the solution fits the individual variables empirically. The solution was regarded as adequate if—in addition to clinical evidence and face validity—at least 90% of cases were correctly classified. Some participants had missing data in the drug abuse variables in some follow-up questionnaires. If this was the case in only one follow-up assessment, the missing data were replaced by the corresponding modal value. More follow-up data were missing in four patients with regard to heroin and cocaine and in four patients with regard to alcohol. These patients were omitted from the corresponding calculations. Odds ratios (ORs) were calculated to identify relevant pre-MMT predictors and associations between longitudinal use of different substances. To control the effect of methadone dose on the typical patterns of additional drug use, we carried out one-way analysis of variance and discriminant analysis.

3. Results

3.1. Frequency of substance abuse

The frequencies of heroin, cocaine, and alcohol abuse on admission and during the treatment are shown in Table 2.

Table 2

Frequency of heroin, cocaine, and alcohol abuse during the course of 2-year methadone treatment

	Heroin	Cocaine	Alcohol
Total <i>n</i> (%) on admission	103 (100)	103 (100)	98 (100)
Total <i>n</i> (%) on all subsequent time points	99 (100)	99 (100)	99 (100)
No abuse [<i>n</i> (%)]			
On admission	0 (0)	38 (37)	30 (31)
After 6 months	39 (39)	50 (51)	36 (36)
After 12 months	40 (40)	54 (55)	35 (35)
After 18 months	47 (47)	56 (57)	33 (33)
After 24 months	48 (48)	62 (63)	40 (40)
Occasional abuse [<i>n</i> (%)]			
On admission	41 (40)	41 (40)	47 (48)
After 6 months	51 (52)	40 (40)	39 (39)
After 12 months	51 (52)	39 (39)	44 (44)
After 18 months	41 (41)	36 (36)	43 (43)
After 24 months	37 (37)	28 (28)	38 (38)
Daily abuse [<i>n</i> (%)]			
On admission	62 (60)	24 (23)	20 (20)
After 6 months	9 (9)	9 (9)	24 (24)
After 12 months	8 (8)	6 (6)	20 (20)
After 18 months	11 (11)	7 (7)	23 (23)
After 24 months	14 (14)	9 (9)	21 (21)

For each time point, data on abuse for the last 4 weeks preceding the questionnaire completion are shown. Before starting their MMT, all 103 patients had used heroin, 65 (63%) also abused cocaine, and 67 (68%) of 97 (missing data in 6 patients) abused alcohol. The number of patients abusing heroin decreased significantly after methadone treatment had been initiated, from 100% at the beginning to 61% after 6 months and to 51% after 24 months ($\chi^2 = 37.03$, $p < .001$, and $\chi^2 = 46.02$, $p < .001$, respectively). Similarly, the number of patients abusing cocaine decreased from 63% at the beginning to 49% after 6 months and to 37% after 24 months (binomial test exact $p = .007$ and $\chi^2 = 17.36$, $p < .001$, respectively). With regard to alcohol abuse, no comparable significant shifts were observed.

3.2. Longitudinal individual patterns of additional substance abuse

Data on cross-sectional frequencies of additional substance abuse—as shown in Table 2—do not reveal any information about individual long-term profiles of such abuse. To identify the corresponding individual long-term patterns, we subjected the biannual data to a series of cluster analyses. A cluster analysis was computed separately for each drug, and the drug abuse before admission was not included.

The results are shown in Table 3. All analyses yielded a three-cluster solution. In each analysis, the patients were divided into three groups in which they were classified as drug abstainers, intermittent drug users, and chronic drug users. The subsequent discriminant analysis that included the biannual data about the drug use as an independent variable and the cluster solution as a dependent variable

Table 3
Longitudinal patterns of drug abuse

Follow-up period	Substance abuse	Heroin abstiners (<i>n</i> = 26; 100%)	Intermittent heroin users (<i>n</i> = 39; 100%)	Chronic heroin users (<i>n</i> = 34; 100%)	Cocaine abstiners (<i>n</i> = 39; 100%)	Intermittent cocaine users (<i>n</i> = 32; 100%)	Chronic cocaine users (<i>n</i> = 28; 100%)	Alcohol abstiners (<i>n</i> = 19; 100%)	Intermittent alcohol users (<i>n</i> = 47; 100%)	Chronic alcohol users (<i>n</i> = 33; 100%)
6 months	None	61	54	6	100	31	4	100	32	6
	Occasional	39	41	73	0	59	75	0	64	27
	Daily	0	5	21	0	9	21	0	4	67
12 months	None	100	31	6	100	43	4	100	32	3
	Occasional	0	67	73	0	53	79	0	68	36
	Daily	0	3	21	0	3	18	0	0	61
18 months	None	100	54	0	100	53	0	100	30	0
	Occasional	0	46	68	0	47	75	0	70	30
	Daily	0	0	32	0	0	25	0	0	70
24 months	None	100	56	0	100	72	0	100	40	6
	Occasional	0	41	62	0	28	68	0	60	30
	Daily	0	3	38	0	0	32	0	0	64

Values are expressed as percentages.

confirmed the goodness of the solution in all three analyses: It was able to correctly capture 98% of identified heroin use patterns, 97% of cocaine use patterns, and 95% of alcohol use patterns.

Drug abstiners abstained from cocaine and alcohol from the very beginning of MMT, in the case of heroin from an early stage of treatment; intermittent drug users switched between periods of abstinence and occasional abuse; and chronic drug users continued to take their substance of abuse during the whole 2-year period of MMT studied.

3.3. Relationship between patterns of abuse of individual substances

Of 96 patients for whom the corresponding data sets were complete, 14 (15%) abstained from heroin and cocaine during the whole 2-year study period of MMT, 4 of them (4% of the whole sample) were total abstiners, also abstaining from alcohol. In contrast, 16 (17%) patients were chronic users of both heroin and cocaine and 5 of them (5% of the whole sample) were chronic users of heroin, cocaine, and alcohol.

A relationship between the longitudinal patterns of additional abuse of individual drugs during MMT was found. In particular, heroin abuse and cocaine abuse seem to parallel each other to some degree: The majority of the 54% of heroin abstiners were also cocaine abstiners, and 47% of chronic heroin users were also chronic cocaine users. The OR for a heroin abstainer to be a cocaine abstainer was 1.79 (95% CI, 0.93–3.46); however, the OR for a chronic heroin user to be a chronic cocaine user was 2.25 (95% CI, 1.35–3.76). Only 8% of heroin abstiners were chronic cocaine users; the OR for a heroin abstainer to be a chronic cocaine user was 0.21 (95% CI, 0.05–0.86). In contrast, no significant relationship was found between patterns of additional abuse of heroin and alcohol. Most

intermittent cocaine users (56%) were daily alcohol users with an OR of 2.43 (95% CI, 1.38–4.28).

3.4. Prediction of the longitudinal patterns of abuse

A series of variables were tested to identify possible predictors of allocation of patients into the three categories of additional long-term abuse. Included were sex, age, occupational status, provision of social benefits, and duration of pretreatment heroin abuse. No statistically significant result was obtained, with only two exceptions: First, chronic alcohol use was more frequent among younger patients (<30 years) than among older patients (>30 years), 43% versus 24%. The OR for a younger patient to become a chronic alcohol user was 1.50 (95% CI, 1.02–2.20). Second, chronic alcohol use was more frequent among patients with a longer history of heroin abuse (>10 years) than among patients with a shorter history of heroin abuse (<10 years), 53% versus 23%. The OR for a patient with a longer history of heroin abuse to become a chronic alcohol user was 2.18 (95% CI, 1.30–3.64).

We also tested the intensity of pre-MMT substance use as a predictor of the longitudinal pattern of additional drug abuse. We considered intensive daily heroin, cocaine, and alcohol abuse on one hand and cocaine and alcohol pre-MMT abstinence on the other. Daily pre-MMT heroin, cocaine, and alcohol all predicted chronic alcohol use, the ORs being 1.39 (95% CI, 1.04–1.86), 2.18 (95% CI, 1.08–4.41), and 34.00 (95% CI, 4.73–244.20), respectively. Pre-MMT cocaine abstinence predicted cocaine abstinence and significantly decreased the probability of chronic cocaine use during MMT; the ORs were 4.61 (95% CI, 2.40–8.73) and 0.15 (95% CI, 0.04–0.58), respectively. Similarly, pre-MMT alcohol abstinence predicted alcohol abstinence and significantly decreased the probability of chronic alcohol use during MMT; the ORs were 4.95 (95% CI, 3.00–8.18) and 0.22 (95% CI, 0.07–0.68), respectively.

3.5. Methadone treatment and patterns of abuse

The average dose of methadone varied between 60 and 70 mg during the observation period. All groups showed variations in the dose; during the treatment and at the individual follow-up points, some differences between the groups could be observed. These, however, were not systematic: Chronic heroin users were provided with less methadone than both abstainers and intermittent users at the beginning of the treatment, but this was reversed after 18 months. Chronic cocaine users received higher doses of methadone than cocaine abstainers and intermittent users throughout the whole study period. Finally, occasional alcohol users were substituted on a lower level than daily alcohol users and alcohol abstainers.

4. Discussion

Continued drug abuse during MMT represents a complication and, perhaps, a partial failure of MMT. As such, it deserves our attention. We studied the additional abuse of heroin, cocaine, and alcohol—the most frequently abused substances in our population of heroin-addicted individuals—having assessed the 103 study patients repeatedly over a 2-year period. All our study patients were heroin dependent and started their MMT as active heroin users during the 3-year period from 1996 to 1998; they all stayed in the methadone program for the whole 2-year study period and adhered to the study protocol, including repeated assessments. Compared with a larger pool of heroin-addicted individuals who entered MMT at the same center and at the same period but did not fulfill the other requirements to be eligible for the study, the study patients appeared to have slightly better social adjustments. Otherwise, no differences were found. Nevertheless, only a small number of variables could be considered in this comparison; the study patients were more compliant than dropouts by definition. In comparison with the patients entering abstinence-oriented treatment programs in Switzerland (Research Association of Therapeutic Communities for Drug Users. Annual Report, 1999, unpublished), these patients undergoing MMT were older, had a longer history of drug abuse, and were more frequently receiving social welfare.

The present study relies on self-reported data on substance consumption. The validity of such self-reports has been widely discussed, and it has been claimed that there is a good correspondence between self-reported data on substance use and the results of urine tests if the patients do not have to fear negative sanctions because of their substance use (Rutherford, Cacciola, Alterman, McKay, & Cook, 2000; Ward et al., 1998). As mentioned, this was the case in our program, the additional nonprescribed substance abuse being regularly addressed without any negative consequences. The subsequent comparison of our patients' self-reports with urine tests indicated a low proportion of

underreporting, considering the possible time gap between the self-reported drug intake and the urine test in many instances.

As the results indicate, the continued drug abuse by heroin-addicted individuals before and during MMT was relatively frequent. Before starting with methadone, our study patients not only abused heroin but also abused cocaine (63%) and alcohol (69%). At the end of the study period, 2 years later, 62% still—at least occasionally—abused heroin, 37% did cocaine, and 60% did alcohol, despite their regular methadone intake. It is important to mention that these figures were obtained in a selected group of compliant patients. Higher prevalences of additional drug use should therefore be expected in the total population of methadone-treated heroin-addicted individuals. During the 2-year study period of MMT, total abstinence was only rarely encountered (in 4% of the sample). On the other hand, some longer-lasting positive trends such as an increasing number of patients abstaining from heroin and cocaine were observed.

As other studies have shown, methadone substitution can reduce illicit drug use and consequent harm in heroin-addicted individuals (Ball & Ross, 1991; Gollnisch, 1997; Ward, Mattick, & Hall, 1992; Ward et al., 1998; Wasserman et al., 1998). Reduction of cocaine use in methadone patients has repeatedly been documented (Ball & Ross, 1991; Borg, Broe, Ho, & Kreek, 1999), whereas the influence of methadone treatment on alcohol use has been examined less frequently (Chatham, Rowan-Szal, Joe, & Simpson, 1997). We are inclined to ascribe our patients' improvements to their adherence to MMT and continuous methadone intake. However, as no control or comparison group was included in our exploration, it is not possible to make such claims.

Cross-sectional analysis gives no information about the behavior of individuals in the course of time. To get such information, we carried out a series of individual cluster analyses with regard to abuse of heroin, cocaine, and alcohol. In all instances, three clusters of patients were identified, each with different longer-lasting patterns of substance abuse. They correspond to "natural classes of treatment response" (Morrall et al., 1997).

1. In the first group of drug abstainers, the patients indicated at each interview that they had stopped their heroin and/or other substance of abuse. This termination was usually immediate in the case of cocaine and alcohol but generally occurred between the 6th and the 12th months of treatment in the case of heroin. Accordingly, early elimination of substance abuse has been found to correlate with a positive treatment course (Morrall, Belding, & Iguchi, 1999).
2. The group of chronic drug users includes patients who admitted at each interview to having consumed heroin, cocaine, and/or alcohol. Again, such patients

were identified with regard to all three substances we studied. In this group, there was a tendency to actually increase their abuse of heroin and cocaine.

3. Finally, there was a group of intermittent drug users who vacillated between periods of abstinence and abuse. In the case of heroin, this pattern remained the same over the whole observation period; in the case of cocaine, there was some tendency toward abstinence during the course of treatment; and in the case of alcohol, the changes were not prominent and most continued as “moderate alcohol users.”

We do not think that methadone dose was a decisive determinant of the different patterns of additional abuse we identified. Nevertheless, this conclusion may be compromised by the clinical practice to alter methadone dose in response to the pattern of ongoing heroin use. Chronic users of heroin were given higher doses; heroin abstainers were prescribed lower methadone doses over the course of the study. The differences were not statistically significant, however, and, obviously, more research is needed in this regard.

Considering the relationship between the longitudinal patterns of abuse of individual drugs, the results demonstrate that no systematic switches from one drug to another took place during MMT, especially in the case of heroin and cocaine. On the contrary, the patterns of concurrent use of these drugs seem to parallel each other. Continued heroin use was found to be more frequent in patients also abusing cocaine (Hartel et al., 1995). In this study, we could not confirm the adverse relationship between alcohol and heroin consumption that has been reported by others (Anglin et al., 1989; Hser et al., 1990). In fact, within this sample, it was the cocaine abusers who appeared to have a higher probability of becoming chronic alcohol users.

Most studies have failed to find robust sociodemographic or other pretreatment predictors for the success of MMT (Favrat, Rao, O'Connor, & Schottenfeld, 2002; Morral et al., 1999). Regarding the prediction of continued drug use during MMT, a favorable outcome was noted in females (Schottenfeld, Pakes, & Kosten, 1998) and in older motivated patients (Simpson, Joe, & Rowan-Szal, 1997). In contrast, pretreatment severity of addiction and some personality factors predicted concurrent heroin and cocaine use (Alterman, Rutherford, Cacciola, McKay, & Boardman, 1998; Avants, Margolin, & McKee, 1999). Illicit drug use during MMT was not predicted by the frequency of previous heroin use, poor psychosocial adjustment, and a history of health problems (Favrat et al., 2002); by cannabis use (Epstein & Preston, 2003); or by comorbidity with personality disorder (Cacciola, Rutherford, Alterman, McKay, & Snider, 1996). Similarly, the allocation of our patients into one of the three groups (abstainers, intermittent drug users, chronic drug users) could not be predicted with the help of the few sociodemographic variables we studied, except for chronic alcohol use having been predicted by younger age.

Longer history of heroin abuse and its pre-MMT daily consumption predicted additional chronic alcohol use during MMT. With this exception, however, the intensity of pre-MMT heroin abuse showed no predictive power; furthermore, the pattern of additional heroin consumption during MMT was independent of the intensity of pre-MMT consumption of cocaine and alcohol. In contrast, the intensity and the kind of pre-MMT cocaine and alcohol use mostly stayed the same during MMT.

Calculations of individual longitudinal patterns of additional nonprescribed substance use during MMT give clinically relevant information that cannot be supplied by data based on point prevalences only. For example, as shown, patients can additionally abuse substances at one point in the course of MMT but may not do it at another point, thus alternating between abuse and abstinence. Such patients should be identified and helped to achieve permanent abstinence. Patients with continued chronic abuse could, perhaps, be considered less-suitable candidates for MMT. However, we must be careful with hasty conclusions in this respect as there may still be good reasons for keeping such individuals in treatment: to reduce current harm associated with their lifestyle, to attempt to build a therapeutic relationship with them, and to seek additional reduction in their heroin use in the longer term. Also, alcohol use among patients undergoing MMT seems to deserve more attention, the alcohol problem often remaining hidden behind a more prominent illegal drug problem. As our data demonstrate, at the end of the study, alcohol was the most frequently abused substance. Thus, summing up, the identification of the three patterns of longitudinal additional substance consumption in the course of MMT is not only interesting from a theoretical point of view but also has practical consequences.

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